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The Best of Both Worlds: **Viewing a PC on a TV**

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Introduction

With high definition televisions now common in the home, and the growing trend of multimedia convergence between consumer electronics and computer systems, many people are finding it desirable to view their computer on a television screen instead of a traditional computer monitor.

What appears to be a simple task is often very challenging. Like any task, it can be accomplished only by using the right tools, each carefully selected for the job.

Computers and televisions, as display devices, were developed along two different paths, and their video works very differently. Those differences create potential roadblocks that must be overcome to make a computer's output signal compatible with a television and achieve a desirable result.

The four primary challenges that must be overcome are:

- Colorspace compatibility
- Resolution compatibility
- Refresh Rate compatibility
- Image Size (Overscan)

Model 1366 PC/HD Scaler

Audio Authority Corp. offers several devices to assist in overcoming these obstacles. These tools will enable even the uninitiated to display a computer's output successfully on a high definition television.

The purpose of this document is to explore how computer and HD video differ, the reasons such converter devices are necessary, and to discuss several applications, suggesting which Audio Authority product would be best for each.

Do I Even Need a Converter?

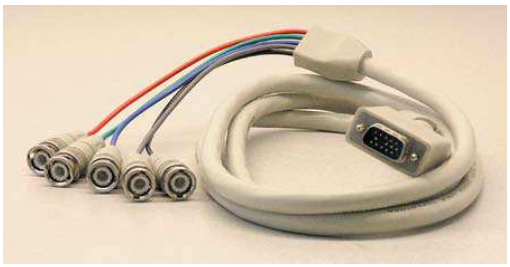
If your television and computer **both** have matching VGA, DVI-I, or HDMI ports, you probably don't need a converter. Most computers offer either VGA or DVI-I (which can usually be adapted to VGA) output. If the same input is available on your display device, you can probably hook the computer up directly using a standard VGA, DVI, or HDMI cable. Check to make sure those inputs accept the output resolution and refresh rate your computer offers.


A typical computer graphics card, including a variety of video connections like DVI and VGA.

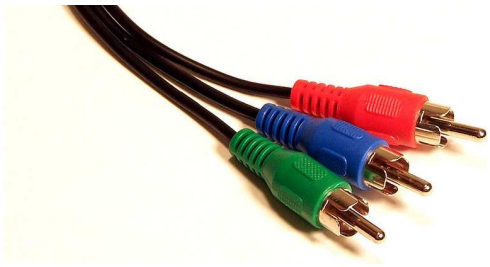
However, many computers only offer VGA outputs. Many television manufacturers have eliminated "non-essential" inputs from their digital televisions to cut costs, so you may be presented with a mixture of inputs – composite, s-video, component, or HDMI. These may not be directly compatible with your computer.

Composite and s-video only provide very low resolutions, incapable of accurately rendering text or detailed images, and should be disregarded for PC on HDTV applications. Component video inputs generally can display a computer's full resolution, so they could be utilized. HDMI is also capable of handling the resolutions demanded for computer applications. If you are unable to natively connect your PC to your display as outlined above, you will need a converter.

Steps to Achieve Perfection – Colorspace, Resolution, Refresh, and Overscan



RGBHV "Breakout" cable with BNC plugs and HD-15 connector



Component video cable (YPbPr) with RCA plugs

Colorspace, or "Why Do I Need a Converter?"

Few people are aware of the differences in various video signal types, assuming "video is video". This couldn't be further from the truth.

VGA is a generic term sometimes applied to "HD-15" connectors, which are 15-pin connectors. VGA connections are generally carrying an RGBHV signal. "RGBHV" signal is sometimes abbreviated as RGB.

RGBHV stands for Red/Green/Blue/Horizontal Sync/Vertical Sync. It requires five pathways to pass its signal. Component video uses the "YPbPr" colorspace, and its three cables are often terminated with RCA or BNC plugs. Component video is sometimes erroneously referred to as RGB due to the common red, green, and blue coloration of its RCA jacks. RGB is **not** component video.

YPbPr includes luminance (black and white information) and sync (Y), blue image data (Pb), and red image data (Pr), and needs *three* pathways to pass these signals. Green is generated from a complex mathematical formula, and does not exist natively on the cables. The "green" cable is luminance and sync, and includes no color.

RGB and YPbPr are completely different colorspaces, and are incompatible with each other in their native states. Simple "VGA to Component" cables are not capable of active signal conversion – they simply can't work in such an application because they only switch the connector type, leaving the actual signal unchanged.

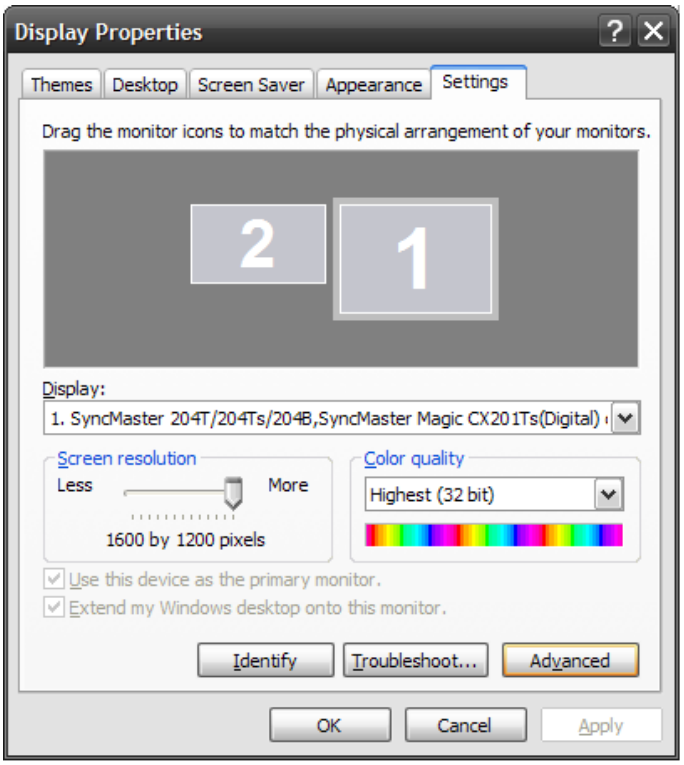
Solution: To address this issue, a quality converter, like our Audio Authority **Model 9A60**, **Model 1365**, **Model 1366**, or **Model 1385** must be purchased to convert the colorspace.

Resolution Compatibility

The next step in making a computer's output viewable on an HD television is to convert the computer's output resolution to one compatible with the television's inputs.

Examine the video output settings on your computer. You will likely see a resolution such as 1024x768, 800x600, or perhaps 1440x900.

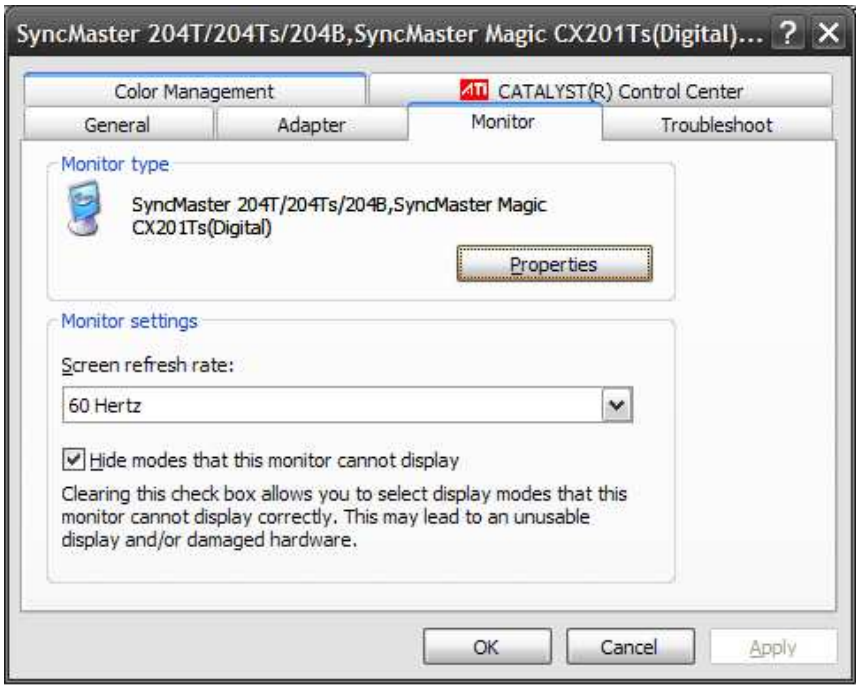
Most of today's HDTVs will not accept the above resolutions via their component video or HDMI inputs. Those connections expect standard consumer electronics video resolutions, not computer standards. Component inputs often only support 480i, 480p, 720p, and 1080i signals. HDMI inputs often accept only 480p, 720p, 1080i, and 1080p signals. Check your display device's manual for its supported resolutions.



Solution: Manually select a computer resolution that is directly compatible with the HDTV set (1280x720, for example), or use a third party software program (PowerStrip, DisplayConfigX) to achieve such a resolution.
A simpler option would be to use an outboard video scaler (like the Audio Authority **Model 1365**, **Model 1366**, or **Model 1385**) that can be used to make both the resolution and refresh rate compatible without adjusting the computer's video output.

Refresh Rate Compatibility

Take a look at your computer's settings again - the refresh rate might be anywhere from 60 Hz to 85 Hz, or above (this is the number of times a device is asked to renew what is on the screen).



Most televisions can only accept 60 Hz refresh rates (50 Hz is common in countries that use the PAL standard) – higher refresh rates could even potentially damage your television set! Some 1080p televisions will accept 24 Hz as a refresh rate, but that's far too low for computer applications. 120 Hz televisions won't accept 120 Hz input – instead, they convert incoming 24, 30, or 60 Hz video to 120 Hz internally.

Computers often run at high refresh rates, so it is important to set the PC refresh rate to one that is accepted by the HDTV—typically 60 Hz.

Caution: Never apply a custom refresh rate setting without first confirming your television is compatible with that setting!

Solution: Adjust the computer's refresh rate to one directly compatible with the HDTV set (60 Hz, most commonly) or use a third party software program (PowerStrip, DisplayConfigX) to achieve such a refresh rate.

A simpler option would be to use an outboard video scaler (like the Audio Authority **Model 1365**, **Model 1366**, or **Model 1385**) that can be used to make both the resolution and refresh rate compatible without adjusting the computer's video output.

Image Size (Overscan)

Have you ever noticed that televisions seem to cut off parts of the image around the edges of the screen? This is due to overscan.

Overscan tolerance was built into television sets and broadcasts due to several CRT-related phenomena, such as image centering irregularities and "stopping" the horizontal motion of the electron beam. Some video synchronization information is also drawn in the "overscanned" area of the image. One of the most unique attributes of computer versus television images is that computer monitors do not overscan at all – properly adjusted, the entire image is contained within the frame of the computer monitor. They might even be "underscanned" somewhat.

Since televisions "overscan" their video inputs (with a few exceptions), one major challenge remains – making the image fit the screen so important image data (like the "Start" bar on Windows computers) is not lost.

Solution: In most cases, an outboard scaler will have to be used, or image size will need to be adjusted within the computer itself, using:

PowerStrip for PC (www.entechtaiwan.com), or
DisplayConfigX for Mac (http://www.3dexpress.de/).

Some manufacturers offer high end graphics card drivers that include an image size adjustment wizard as well. Most outboard devices don't have the "screen size" controls necessary to make the appropriate adjustments. In some situations, especially with video being played, however, it isn't important to completely eliminate overscan.

The most capable video scalers and processors can control image sizing, helping assure a better fit to the screen. The Audio Authority **Model 1366** and **Model 1385** have built-in image size controls, making them perfectly suited to address the challenge of image size control.

The Solution: Video Converters and Scalers from Audio Authority

Audio Authority has four solutions for the "PC to HDTV" dilemma.

The **Model 9A60 VGA to Component Transcoder** is a simple transcoder that takes the RGB signal in a VGA output, and converts it to the YPbPr colorspace and appropriate component video connectors. Simply put, it solves the *colorspace* issue, but leaves additional adjustments to the user and their computer.

The **Model 1365 PC/HD Scaler** is a more feature-laden device, which allows for not only colorspace conversion from RGB to YPbPr, but can also make the opposite conversion, from Component/YPbPr back to VGA/RGB.
It also has a built-in video scaler, which can take most computer resolutions and turn them in to a standard video output. It solves the *colorspace*, *resolution*, and *refresh rate* dilemmas. Optimum results can usually be obtained by varying the combination of input and output resolution. The device has an onscreen menu for easy setup.

The **Model 1366 PC/HD Scaler with Advanced Video Processing** is the most capable of Audio Authority's video scaling products for component video. It includes all of the 1365's features, but adds a passthrough port for preserving the original signal, supports far more input and output resolutions, and has image size controls. It solves the *colorspace*, *resolution*, *refresh rate*, and *image size* dilemmas. The device has an advanced onscreen menu for easy setup.

The **Model 1385 PC to HDMI Scaler with Advanced Video Processing** has all the same video processing attributes (solving the *colorspace*, *resolution*, *refresh rate*, and *image size* dilemmas), but outputs HDMI instead of component video. It is best for applications that require an HDMI input instead of component. The device has an advanced onscreen menu for easy setup.

Application Features

These are the three most common PC to HDTV conversion applications we are confronted with on a daily basis – one likely fits your application. Read below to learn which products are best suited to specific applications. "Recommended" devices best fit the requirements of the applications discussed, while "Possible" devices may be more cost effective and have the potential to accomplish a task, but will not necessarily be the quickest or simplest solution to the application.

Application 1: Home – Computer using an HDTV as a Monitor

In this application, the same computer will likely always be hooked to the same TV. The best solution will enable a quick, simple setup and good picture quality with a minimum investment of time. The user can adjust their output settings manually with PowerStrip or DisplayConfigX to create a compatible signal by using the simple 9A60 transcoder, or use a more advanced device with built in signal processing and scaling to achieve the goal more quickly and accurately, without changing their computer's settings.

The **1385** and the **1366** are the simplest, quickest full-service solutions for this application because these devices make the complicated video adjustments outboard, rather than by manipulating the computer's graphics card manually. The **9A60** can yield excellent results, but only after extensive manual setup and adjustment of the source computer. The **1365** is not recommended in this case since it makes no accommodation for controlling image size/overscan.

Recommended:		**Possible:**	**Not Recommended:**
			
1366	**1385**	**9A60**	**1365**

Application 2: Boardroom – Multiple Unknown Laptops Using the same Non-VGA Display Device

In this situation, visitors or multiple employees will likely be using a number of different laptops, operating at different settings, with the same display device. Since significant graphics card tweaking is required to make a 9A60-oriented solution work in most cases, it would be very impractical, if not impossible, to make such changes on each computer that is used in the boardroom. The 1365 is more suited for the application than the 9A60, but has limited resolution capability compared to the more advanced processing chip in the 1366 and 1385.

The 1366 and 1385 would do all signal conversion externally, allowing almost anyone to "plug-and-play" directly into the converter without adjusting any of their computer's other output parameters. The wider range of resolution and refresh rate support from the 1366 and 1385 enable more trouble-free setup, avoiding service calls or incompatibilities.

The **1385** and **1366** are the only recommended devices for this application due to the changing variable presented by different computers (and their differing native resolutions) being used from day to day.

Recommended:

1366

1385

Possible:

1365

Application 3: Converting a Non-Computer "VGA/RGBHV" Source for Use on a Component or HDMI Display

The best device for this application would be based on the resolution and refresh rate being output from the source. If the source is sending out computer-type resolutions, the 1366, 1365, and 1385 would allow for easy conversion of those signals to standard CE signal formats.

If the output is already in a resolution like 480i/60, 480p/60, 720p/60, or 1080i/60, then simple colorspace conversions are all that is needed, the 9A60 would be the best choice.

Based on the situation, either the **9A60**, **1365**, **1366**, **1385** would be acceptable. Most often, the 9A60 is the best choice for component video displays, and the 1385 is the best choice for HDMI requirements.

Recommended:

For component video applications

9A60

For HDMI applications

1385

Possible:

1366

1365